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ABSTRACT

Problems emerging from previous analyses of epenthesis in Japanese verbal endings are discussed and a crucial relationship between epenthesis and assimilation is argued. The focus is on the occurrence of /i/-epenthesis with certain root-final consonants. The analysis, which incorporates the view that assimilation is accomplished by means of autosegmental spreading, illustrates that epenthesis cannot split clusters that have undergone assimilation. Assimilation and epenthesis are seen as complementary, with epenthesis occurring where assimilation has not. (MSE)

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THE MORPHOPHONEMICS OF JAPANESE VERBAL CONJUGATION: AN AUTOSEGMENTAL ACCOUNT*

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Indiana University

1. Introduction

The morphophonemic alternations triggered by the verbal endings in Tokyo Japanese has been well studied (cf. McCawley 1968, Aoki 1981, Tabata 1983, among others). Much attention has focused on accounting for the alternations triggered by suffixes beginning with underlying /t/ such as the past tense suffix -ta and the gerundive suffix -te. Consider the represenative alternations triggered by the suffix -ta shown in (1). (Identical alternations are triggered by the gerundive -te.)

(1)	a.	/tabe + ta/	--->	[tabeta]	'ate'
		/mi + ta/	--->	[mita]	'saw'
	b.	/tor + ta/	--->	[totta]	'took'
		/kaw + ta/	--->	[katta]	'bought'
	c.	/tob + ta/	--->	[tonda]	'flew'
		/yom + ta/	--->	[yonda]	'read'
		/sin + ta/	--->	[sinda]	'died'
	d.	/kas + ta/	--->	[kasita]	'rented'
		/kak + ta/	--->	[kaita]	'wrote'
		/kag + ta/	--->	[kaida]	'sniffed'

The vowel-final roots in (1a) display no alternations. With the consonant-final roots in the forms in (1b-d) there are several alternations that need to be accounted for. The forms in (1b) show complete assimilation of a root-final nonnasal sonorant (/r/ or /w/). The forms in (1c) show several processes. There is regressive place assimilation in which the root-final consonant assimilates in place to the initial /t/ of the suffix. There is also progressive voicing assimilation which converts the suffix-initial /t/ to [d]. And, finally, there is the nasalization of root-final /b/. The forms in (1d) also show several processes. There is the epenthesis of the vowel /i/ between the root-final consonant and the suffix-initial /t/. There is also the deletion of root-final velar stops, and there is voicing assimilation in the form /kag + ta/ 'sniffed'.

Several potential problems emerge from an analysis of these alternations. These include accounting for the deletion of velars but not other consonants in root-final position (like in the last two examples in (1d)) and accounting for the nasalization of root-final /b/ in a context that lacks nasals. The focus of this paper, though, will not be on these problems but on the problem of

accounting for epenthesis. Specifically, why does /i/-epenthesis occur after root-final /k/, /g/, and /s/ in (1d) (which do not obviously constitute a natural class) but not after other root-final consonants in (1b) and (1c). We offer an analysis of epenthesis that crucially relates it to assimilation. We propose that the epenthesis rule as evidenced by the data in (1d) is formalized so as to break up any sequence of two consonants. The failure of epenthesis to apply in the clusters in (1b) and (1c), though, is not problematic. Note that the consonant clusters in (1b) and (1c) either have undergone total assimilation (1b) or place assimilation (1c). In our analysis, which incorporates the view of Hayes's (1986a) that assimilation is accomplished by means of autosegmental spreading, we show that there is a crucial relationship between epenthesis and assimilation. Namely, epenthesis cannot split up clusters that have undergone assimilation. We argue that the application of epenthesis to the assimilatied clusters in (1b) and (1c) would result in an illicit crossing of association lines. Assimilation and epenthesis then complement each other: epenthesis occurs where assimilation has not. Before detailing our analysis, we first consider critically some of the previous analyses of /i/-epenthesis.

2. Previous Analyses

Previous analyses of /i/-epenthesis have been unable to offer a principled account on why the vowel /i/ occurs after roots ending in /k/, /g/, or /s/ but not after roots ending in other consonants. /k/, /g/, and /s/ do not seem to constitute a natural class. In order to handle the problem of /i/ inserting after a nonnatural class, McCawley (1968) posits a rule that essentially converts velar stops to fricatives before obstruent-initial suffixes, such as -ta. Another rule subsequently follows which inserts /i/ after any root-final fricative. The velar fricatives later delete. Sample derivations of the forms in (1d) under McCawley's account are provided in (2). (G = voiced velar fricative.)

(2)	/kas + ta/	/kak + ta/	/kag + ta/
(a. Voicing Assm.)	-----	-----	kagda
b. k,g ---> x,G	-----	kaxta	kaGda
c. i-epenthesis	kasita	kaxita	kaGida
d. velar deletion	-----	kaita	kaida
	[kasita]	[kaita]	[kaida]

One shortcoming of McCawley's (1968) analysis is that it posits velar fricatives which do not otherwise occur in Japanese.

Moreover, even though converting velar stops into fricatives allows for a somewhat more natural epenthesis rule (ie, /i/ is epenthesized after root-final fricatives), there is still no explanation on why it is that root-final fricatives are involved in epenthesis and not some other class of sounds.

A somewhat similar analysis is that of Aoki (1981). He, like McCawley, tries to form a natural class out of /k/, /g/, and /s/. Aoki suggests that these are all [-anterior]. He speculates that Japanese /s/ is actually [-anterior] because it is pronounced slightly further back than /t/, /d/, and /n/. These latter sounds are dental while /s/ is alveolar. The /i/-epenthesis rule then would insert /i/ after root-final [-anterior] consonants. Aoki, though, does not offer any independent arguments for considering Japanese /s/ as [-anterior]. Even if there were to be independent evidence for considering /s/ in Japanese as [-anterior], there still would be no principled reason why it is just root-final [-anterior] consonants that /i/ is inserted after and not other root-final consonants.

The nonlinear analysis of Tabata (1983) takes a different strategy. Tabata posits that all Japanese verbal roots end in a CV-sequence on the CV-tier. The difference between the verbal roots in (1a) and those in (1b)-(1d) is that those in (1a) have a root-final vowel on the phoneme tier while those in (1b)-(1d) do not have a root-final vowel phoneme. In other words, according to Tabata, the forms in (1b)-(1d) all end with a final empty V-slot. This difference in roots is illustrated in (3).

(3) a. C V C V b. C V C V c. C V C V d. C V C V
       | | | | | | | | | | | | |
       t a b e   t o r   t o b   k a s

Tabata then posits the following two rules in (4) which apply disjunctively:

(4) a. ∅ ---> i / σ]
                 / \ stem
               C   V
               |
               a   _ (__)[+T]

                  a = velar or continuant

b. σ]
   / * stem
 C   V
 |
 a   (__) [+T]

The rule in (4a) inserts an /i/ into an empty V-slot which is before a suffix-initial /t/ and after a velar or continuant consonant. The rule in (4b) deletes an empty V-slot whenever (4a)

has not applied. We see then that Tabata's analysis of epenthesis, despite its nonlinear formalism, is quite similar to other previous analyses because it stipulates that the phoneme /i/ is inserted after a root-final velar or continuant. There is still no apparent reason why it is these consonants that /i/ is inserted after and not some other set of consonants. Thus we see that previous analyses, whether in a linear or nonlinear framework, stipulate that epenthesis occurs after root-final /k/, /g/, and /s/. Even though some of these analyses attempt to make a natural class out of these three consonants, there is still no apparent reason why it is these root-final consonants and not some others that /i/ is inserted after.

3. Assumptions

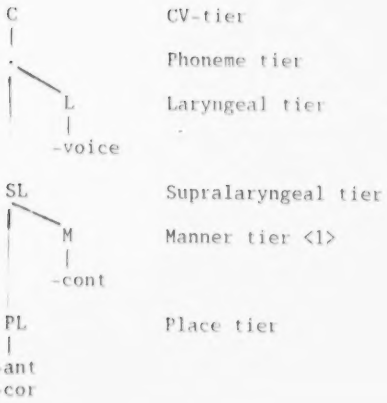
Before presenting our analysis of Japanese epenthesis, we review some crucial aspects of autosegmental theory that we incorporate. Firstly, we assume a theory of CV-Phonology (eg. Clements & Keyser (1983)). We thus view phonological representations as consisting of both a CV-tier and a phoneme tier. The elements on the CV-tier (which consists of C-slots and V-slots reflecting the skeletal pattern of the phonological representation) are linked to the elements on the phoneme tier by autosegmental association lines. (Although we formulate our analysis incorporating a CV-tier it is also compatible with a view like that of Levin (1985) that utilizes an X-tier instead.) Thus, the Japanese word tabeta 'ate' would have a representation in CV-theory like that in (5).

(5)

C	V	C	V	+	C	V		CV-tier
|	|	|	|		|	|		
t	a	b	e		t	a		Phoneme tier

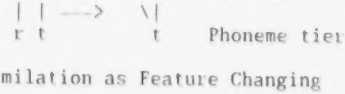
Additionally, we follow Clements (1985) in viewing phonological features as having their own internal structure. Specifically, phonological features that are similar can group together on their own tier. For example, features related to place of articulation would be grouped together on one tier, features related to manner of articulation would be grouped together on a second tier, while features related to the larynx (such as voicing and spread glottis) would be grouped together on a third tier. Thus a phoneme like /t/ would have the representation in (6). (We also follow Clements by incorporating a supralaryngeal tier which immediately dominates both the place tier and the manner tier.)

(6)

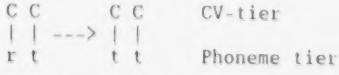


Finally, we follow Clements (1985), Hayes (1986a,b) and Schein & Steriade (1986) in viewing assimilation as being accomplished by means of autosegmental spreading rather than by feature changing. The formal difference between these two views of assimilation, as discusssed by Hayes (1986a), is shown in (7).

(7) a. Assimilation as Spreading



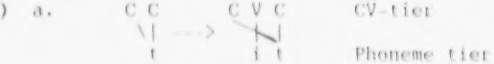
b. Assimilation as Feature Changing



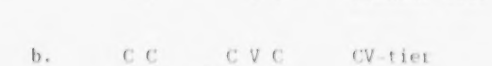
One of the main arguments for viewing assimilation as autosegmental spreading rather than feature changing comes from the way in which geminates would be represented. This is shown on the right side of the arrow in (7). In (7a), a geminate is represented as one element on the phoneme tier linked to two C-slots on the CV-tier. As has been pointed out by Hayes (1986a) and Schein & Steriade (1986), the representation of geminates as (on the rightside of the arrow) in (7a) provides a natural explanation for the phenomena of geminate integrity (ie, the inability of rules of epenthesis to split up geminate consonants). If epenthesis inserts a vowel phoneme linked to a V-slot between two consonants, then epenthesis into a geminate like in (7a) would violate the constraint on crossing association lines. This would not be the case if geminates were represented as (on the rightside

of the arrow) in (7b), where a geminate is represented as two separate consonants both on the CV-tier and the phoneme tier. This difference is shown in (8).

(8) a.



b.

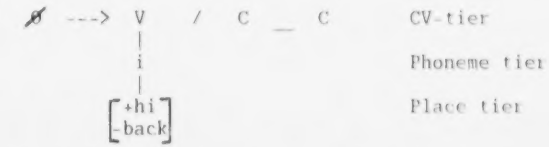


Thus, by incorporating the view that assimilation is achieved through autosegmental spreading, it is predicted that epenthesis would never occur so as to break up a geminate consonant formed by assimilation. As we will shortly see, this prediction is borne out by the Japanese data under consideration.

4. Analysis

Having discussed the shortcomings of several previous analyses of the Japanese i-epenthesis rule in Section 2 and having discussed some of our assumptions in Section 3, we now present our analysis. Our basic proposal is that the Japanese /i/-epenthesis rule is quite general in form. We can formalize the rule using the nonlinear notation in (9).

(9)



The rule states that a V-slot linked to a phoneme with the features [+hi, -back] (ie, /i/) is inserted between two adjacent C-slots.

Let us now consider how the /i/-epenthesis rule in (9) applies (or does not apply) to the data in (1). Firstly, the rule does not apply to the vowel-final roots in (1a) because the environment for the rule is never met. There are no two adjacent C-slots in these forms, as is apparent from the representation of tabeta given in (5). Next, consider the forms in (1d). The forms in (1d) all meet the environment for the rule since, in each of these forms, two C-slots are adjacent. This is seen in the representations of these forms in (10). (The form in (10c) is shown after a rule of progressive voicing assimilation has applied).

(10) a. C V C + C V b. C V C + C V c. C V C + C V
| | | | | | | | |
k a s t a k a k t a k a g d a

The application of /i/-epenthesis to these forms is shown in (11).

(11) a. C V C V C V b. C V C V C V c. C V C V C V
| | | | | | | | |
k a s i t a k a k i t a k a g i d a

(There is a later rule of velar deletion, not dealt with here, which deletes the root-final velars in (7b) and (7c).)

Let us now consider what happens when we try to apply /i/-epenthesis to the forms in (1b) and (1c). The forms in (1b) seem to meet the environment for /i/-epenthesis. As shown by their representations in (12), these forms have two adjacent C-slots on the CV-tier.

(12) a. C V C + C V b. C V C + C V CV-tier
| | | | | | |
t o r t a k a w t a Phoneme tier

However, the roots shown in (12) end in nonnasal sonorants (/w/ and /r/). Root-final nonnasal sonorants assimilate totally to suffix-initial /t/. This assimilation rule can be formulated as in (13).

(13) C + C CV-tier
{ r } t Phoneme tier
{ w }

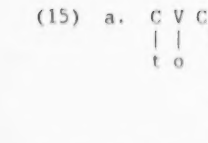
The application of this rule to the two forms in (12) is shown in (14).

(14) a. C V C C V b. C V C C C CV-tier
| | ±\| | | | ±\| |
t o r t a k a w t a Phoneme tier

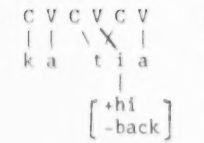
[totta] [katta]

Observe that as a result of the assimilation rule, the suffix-initial phoneme, /t/, is linked to two C-slots on the CV-tier just like the geminate structure in (7a). Given that the result of the assimilation rule in (13) is a geminate consonant, the /i/-epenthesis rule is unable to apply because the resulting forms would have crossing association lines. This is shown in (15) which is parallel to the hypothetical example in (8a).

(15) a.



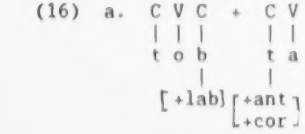
b.



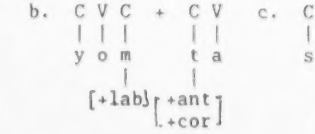
Thus the failure of /i/-epenthesis to apply to the forms in (1b) follows automatically if we accept the view of Hayes (1986a,b), Schein & Steriade (1986) and others that assimilation involves autosegmental spreading. For under such a view, as discussed earlier, a geminate resulting from assimilation cannot be split up by the insertion of a vowel phoneme.

The forms in (1c) also fail to undergo the /i/-epenthesis rule even though, given their underlying representations in (16), it would appear that the environment for the rule is met since there are two adjacent C-slots on the CV-tier.

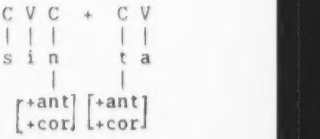
(16) a.



b.

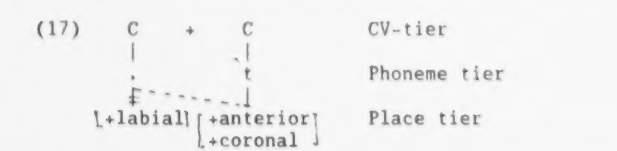


c.



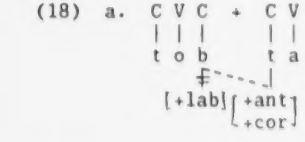
While the forms in (16) do not undergo total assimilation (unlike the forms in (12)), they do undergo place of articulation assimilation. Specifically, the forms in (16a) and (16b) undergo what can be termed "Labial Assimilation". This converts a labial to a dental before a suffix-initial /t/. The rule of labial assimilation is shown in (17).

(17)

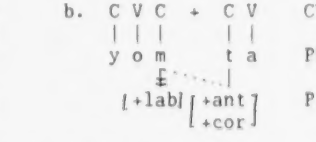


The application of this rule to the forms in (16a) and (16b) is shown in (18). (We ignore here additional rules of voicing assimilation and nasalization.)

(18) a.



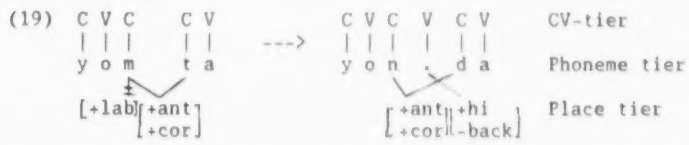
b.



Now, given that the output of Labial Assimilation is a partial

geminate in which the two consonants share the same place of articulation features, and given that the /i/-epenthesis rule inserts place of articulation features, it follows that the epenthesis rule could not apply to the forms in (18) for such would violate the constraint on crossing association lines. This is shown in (19).

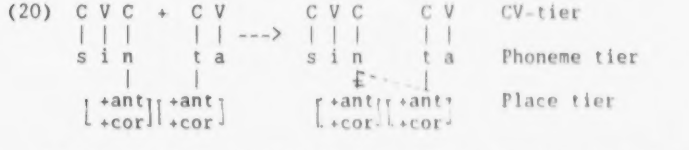
(19)



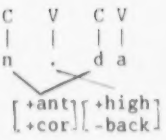
Thus, once again, viewing assimilation as being accomplished by autosegmental spreading leads to a straightforward account for the failure of epenthesis. The rule of /i/-epenthesis inserts place features. The rule of Labial Assimilation creates a partial geminate involving place features. As seen in (19), the epenthesis rule cannot break up such a partial geminate without violating the constraint on crossing association lines. We consider this to be an advantage for the autosegmental analysis proposed here that it relates the failure of epenthesis with the application of assimilation.

Finally, we must account for the failure of epenthesis to the form sinda in (16c). At first glance, it appears that epenthesis should apply inserting /i/ between the two adjacent consonants in sinda since no place assimilation seems to have occurred. However, note that in the representation of sinda in (16c) the place features of the adjacent consonants are identical (both [+anterior, +coronal]). In order to account for the failure of /i/-epenthesis in (16c), we assume that place assimilation does occur between the two adjacent consonants--perhaps due to the Obligatory Contour Principle (ie, a principle ruling out adjacent identical elements on the same tier; see McCarthy (1986) and Odden (1988) for discussion). This is illustrated in (20) (where voicing assimilation is ignored).

(20)



The effects of place assimilation in (20) might seem vacuous, but given that the output of assimilation is a partial geminate on the place tier, /i/-epenthesis cannot subsequently apply because its application would lead to a violation of the crossing lines constraint. This is shown in (21). <2>

(21)


Once again, we see that, by viewing assimilation as being achieved by means of autosegmental spreading, a connection is made between the application of assimilation and the nonapplication of epenthesis.

In summary, in this paper we have considered one problematic aspect of Japanese verbal conjugation: namely, the question of why /i/-epenthesis only applies to verbal roots like in (1d) that end in /s/, /k/, or /g/. We have argued that /i/-epenthesis applies to verb roots ending /s/, /k/, and /g/ because it is only these root-final consonants that do not undergo assimilation with suffix-initial /t/. The application of either total assimilation of a final root consonant (as in 1b) or place assimilation of a final root consonant (as in 1c) creates a geminate structure (a full geminate in (1b) and a partial place geminate in (1c)). If assimilation is viewed as being achieved through autosegmental spreading, then epenthesis cannot apply into a geminate structure for doing such would violate the crossing lines constraint <3>. Thus epenthesis only occurs when assimilation has not. This connection between the application of assimilation and the failure of epenthesis is missed in other analyses of Japanese verbal morphology.

Footnotes

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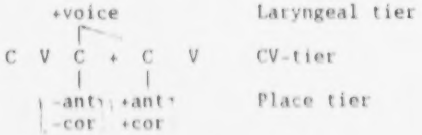
1. The evidence for the manner tier is not as strong as the evidence for the other tiers. Since nothing in this paper crucially depends on whether or not manner features are grouped together on one tier, we assume that they are for convenience.

2. Note that under our analysis place assimilation like that in (20) would seem to apply to a root-final /s/ and a suffix-initial /t/ since both these phonemes are [+anterior, +coronal]. However, no such assimilation occurs. In order to account for this lack of assimilation, we note (as does Aoki 1981)) that /s/ and /t/ do not actually have the same place of articulation: /s/ is alveolar while /t/ is dental. So, while both /s/ and /t/ are [+anterior, +coronal], they differ in the feature [distributed] which is considered to be a place of articulation feature in Sagey (1986) and Steriade (1987). The dental /t/ is [+distributed] and the alveolar /s/ is [-distributed]. Alternatively, we could specify that place assimilation only occurs between two phonemes that are

both [-continuant].

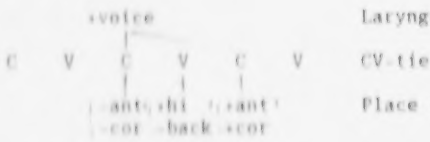
3. We should point out that the application of progressive voicing assimilation to the form /kag + ta/ (phonetically [kaida]) in (1d) does not block /i/-epenthesis. After voicing assimilation has applied to the /t/ in /kag + ta/ there is a partial geminate on the laryngeal tier, as shown in (i). (We place the laryngeal above the CV-tier since we are unable to diagram the representation three dimensionally.)

(i)



Since /i/-epenthesis does not refer to elements on the laryngeal tier, it can apply without violating the constraint on crossing association lines. This is shown in (ii).

(ii)



An assumption made here is that vowels need not be specified for the feature [voice] because voicing values are predictable for vowels in Japanese.

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